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Textile Materials: Tactile Describers

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Abstract: The most important characteristics that affect the apparel products quality and influences the consumer's decision-marking process is the tactile property. Sensory analysis is a new tool for touch evaluation of a fabric and it is based on the determination of the tactile properties (attributes) identified by the consumers. In this research, a panel of 50 judges was used to define the sensory attributes by tactile perception of several textile materials. The final attributes were compared with the ones obtained previously in a similar study in France. This comparison allowed the development of a methodology of sensory evaluation of textile materials and the definition of a standardized sensory profile for European consumer. The majority of the attributes were similarly described by the consumers of both countries (Portugal and France), but others, like shape recovery, were differently identified.

Key words: Sensory analysis, tactile evaluation, textile materials, fabric hand, statistical analysis

INTRODUCTION

Modern consumers consider comfort one of the most important attributes in the purchase of textile and apparel products how show several marketing studies. Therefore, it is needed and important for the textile products a reliable understanding of the psychological perception of clothing comfort sensation.

Sensorial or tactile comfort, identified only by hand touch is essentially a result of how much stress is generated in the material and how it is distributed over the skin and consequently has a strong relationship with both mechanical and surface properties of the fabric (George, 2003). The differences in fabric handle preferences diverge from individual to individual due to the different religion and/or climatic region, cultural background, making the touch a subjective parameter.

To quantify objectively the touch several studies have been carried out to in the last decades. The first research dealing with measurements of perception began in the second half of the 19th century. In the 50s, sensory analysis emerged, first by the development of methods used by food industry and in 1974 in USA, a complete methodology for descriptive analysis was proposed. Since the early 80s, standard methods have been developed and published (Wong *et al*., 2004; Bensaid *et al*., 2006; Hui *et al*., 2004), however, the junction of the most advanced mechanical, electronics and informatics technologies was not enough to substitute the human touch. The sensory analysis have shown a promising tool for taste and smell and has been applied with success on food, cosmetic and automobile industries such as Nestle, L'Oreal, Dior, Fiat, Peugeot and Renault (Chollakup *et al*., 2004; Philippe *et al*., 2003, 2004; Young *et al*., 2005; Armand *et al*., 2005).

Textile materials have been a subject of interest in what concerns sensory analysis. In France was developed a methodology for sensory analysis of touch and the results reported a creation of a sensory profile (Chollakup *et al*., 2004; Philippe *et al*., 2003, 2004).

In Portugal, a previous study using the same methodology presented in this research was developed, however, with some variants. The panel was composed only by 30 judges, the range of ages was also different, being more restrictive and a less number of textile materials were studied (Nogueira *et al*., 2007).

The aims of this study was to develop, a descriptive vocabulary or lexicon, for profiling textiles and compare the final attributes obtained by the new Portuguese judges with the ones obtained by the French judges.

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MATERIALS AND METHODS

Assessor's creation: It was created a panel composed by a group of free volunteers called assessors that described the tactile perception of textile using tactile describers (attributes). The panel of sensorial evaluators was an heterogeneous group including 50 adults with ages between 23-60 years old, individuals of both sex (30 women's and 20 men's) and with different personal taste, scholarship and different knowledge areas.

Textiles materials: In this research, 30 samples with different structures were selected. These samples were all finished products in order to simulate the final product of the basic consumer. The 30 samples included natural (cotton, wool, flax and silk) and synthetic fibres (polyester, polyamide, polyethylene and mixtures of fibres) with different textiles technologies (plain, twill, satin and plain weave), knitted fabrics (interlock, jersey and polar) and nonwovens (spunlaid, drylaid, wetlaid, meltblown and SMMS).

Experimental plan: The assessor's panel analyzed the 30 different materials in a standard atmosphere (65±2% relative humidity and 20±2°C). A specific apparatus was designed (Fig. 1) in order to eliminate the visual factor from the test procedure. The specific apparatus is a box where the evaluators could introduce their hands and to touch the materials without seeing them. At the beginning of the tests, all the assessors washed their hands with the same mild soap and cleaning afterwards with a disposable towel. In order to avoid the decrease of sensitivity of the evaluators that could occur after a long period of evaluation, each session was limited to 30 min.

After tests preparation, the assessors passed their finger tips and their palm hands by the surface of each sample (right and reverse sides) and then they were able to take all the samples on their hands.

Fig. 1: Apparatus for touch evaluation

The assessors write their perceptions after the pass their fingers on the right side of the fabric, than again after pass on the left side and then after pass with both hands on the fabric.

RESULTS AND DISCUSSION

During the evaluation tests, the assessors described and write their sensations using free vocabulary. A list of 338 descriptive attributes was achieved using all the words described by the 50 assessors for the 30 samples. Each attribute of the list described below was considered for several assessors more than once. In order to obtain a smaller list, which contained the final attributes, several attributes were eliminated, using a logical process that is explained further.

First descriptive attributes selection: The first selection of attributes was achieved using the panel contribution and the procedure was followed by eliminating

- The hedonic terms such as pleasant and unpleasant or comfortable and uncomfortable
- The attributes that described final material applications like towels, clothes and others
- Descriptions corresponding to a characteristic of the material, i.e., cotton, linen, wool, warp and weft
- The non pertinent terms mentioned like personal tastes
- Non quantifying terms such as resistant or absorbent
- The attributes that were not similarly described by the panel (e.g., rubbing)
- The ones that are related with other sensing like visual or audition according to the NF-ISO 11035 standard procedure

After this procedure, it was attained a list with 72 descriptive attributes, which were joined, with the panel collaboration, according to the real final meaning. Different assessors used different describing words for the same final attribute; therefore, a standardization of each attribute was performed, according to the BP ×10-040 standard method by joining the similar words and choosing the one that was considered the best describer. Beside this methodology applied, the attributes that described an intensity scale were chosen to exhibit only the extreme values (e.g., warm-tepid-cold-frozen-neutral was replaced by cold-warm). The final attributes attained are shown in Table 1.

Table 1: Final table of 26 attributes after the 1st selection

Warm	Cold	Fluffy	Dense	Uneven	Granulous	Elastic
Crumple	Thick	Thin	Light	Smooth	Heavy	Dry
Soft	Pilous	Stick	Wet	Rugous	Slippery	Sleep
Rigid	Shape recovery	-	-	Rough	Falling	Supple

Second descriptive attributes selection: The 26 descriptive attributes (Table 1) previously attained were submitted to the panel evaluation. Each member of the panel classified these describers using a 0-10 scale (0-no sensation, 10-high sensation) (Nogueira *et al*., 2008).

After this evaluation, it were calculated the frequency and intensity of each attribute. In this calculation were considered not only describers less cited with high intensity, but also describers with low intensity and frequently cited. Table 2 shows, the attributes by classification order.

Sequentially to describe the data a multidimensional statistical method was applied. So, correlation matrix of attribute/material was constructed and statistical analysis of principal components was performed in order to join the similar attributes (positive correlation) and the opposite attributes (negative correlation) that allowed the elimination of attributes with less significance and detach the main differences between them. In addition, a sensory map of descriptive attributes was constructed allowing the identification of the antagonist and similar terms considered by the panel (Fig. 2).

From sensory map of descriptive attributes, it was possible to identify the bipolar terms that are described:

- Cold-warm
- Supple-rigid
- Rough-smooth
- Sleek-rugous
- Heavy-light
- Thin-thick
- Wet-dry

Similar descriptive attributes like soft/smooth and heavy/thick/dense were also, identify and joined. At the end the descriptive attributes selected were smooth that was considered by the panel as the antagonist of rough. Thick attribute was selected by the same reason of the last one.

The sensory map for descriptive attributes shows, that the attributes wet and dry should be considered, however, the panel decided to eliminate them from the final list. This decision was based in the fact that dry is associated to rough, that is already included in the list and wet is associated to cold that is also included in the final list of attributes. The 15 final descriptive attributes attained by Portuguese panel were divided in three different groups, according to the evaluated parameters (Table 3).

Table 2: Geometrical mean attained for each attribute

Attribute	Geometrical mean
Sleek	75.32
Falling	71.85
Smooth	66.56
Supple	65.93
Slippery	65.83
Soft	65.60
Warm	65.11
Light	62.29
Dry	57.94
Thin	56.72
Thick	54.21
Weighty	51.69
Shape recovery	51.11
Dense	51.09
Rough	50.72
Fluffy	50.39
Cold	48.96
Pilous	46.99
Rugous	46.74
Rigid	45.48
Crumple	44.95
Elastic	39.24
Uneven	38.58
Granulous	35.79
Wet	27.83
Stick	24.04

Table 3: Final 15 attributes retained by the portuguese panel

Bipolar	Surface	Material
-	Pilous	-
Cold-warm	Granulous	Falling
Supple-rigid	Sticky	Shape recovery
Heavy-light	Slippery	Crumple
Thin-thick	Fluffy	Elastic
Rough-smooth	-	-
Sleek-rugous	-	-

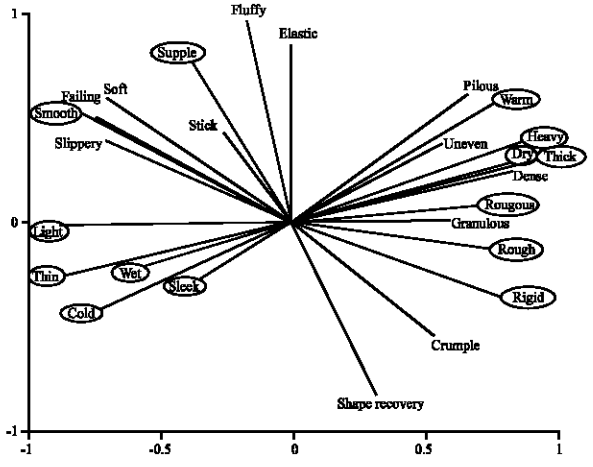

Fig. 2: Sensory map of principal components analysis for descriptive attributes (2nd selection)

DISCUSSION

Comparison between portuguese and french final descriptive attributes: Based on the same methodologies adopted in Portugal, the French panel defined in a

Table 4: Final 15 attributes retained by the french panel

Bipolar	Surface	Materials
-	Pilous	-
-	Soft	-
Cold-warm	Granulous	Falling
Supple-rigid	Sticky	Nervous
Heavy-light	Slippery	Crumple-like
Thin-thick	Grooved	Elastic
-	Greasy	-

previous study, 15 final descriptive attributes (Table 4). Comparing both final lists obtained it was observed that from all the 15 final descriptive attributes, 11 are common to the two different panels. Two differences were however, attained. The French panel defined the attributes soft instead of rough-smooth adopted by Portuguese panel. In this case, a bipolar attribute was preferred. For the same reason, the Portuguese panel selected the attributes sleek-rugous instead of grooved, chosen by the panel in France.

The final attribute that define the shape behaviour of the materials was defined using different approaches. In France, the panel defined the materials as nervous. On the other hand, the Portuguese panel considered the typical property definition to describe the final attribute as shape recovery.

Totally, different attributes were observed when analysing both final descriptive attributes. The French panel defined greasy as a final attribute, which is considered an antagonistic term compared with the one obtained in Portugal, fluffy.

CONCLUSION

The touch is still a subjective parameter of complex evaluation. This research shows a considerable similarity between the preferences of the panel of both countries studied (Portugal/France) besides the totally different attribute attained by both panels (grease/fluffy). According to these results, it is possible to compare both European consumers and reach a sensory profile well standardized. The results attained in this study corroborate the ones obtained in the preliminary study (panel of 30 judges).

Practical applications: Textile materials, like fibers, yarns, surfaces and clothes must be projected taking into account the decisive comfort standard parameters of consumers. The comfort involves different characteristics including the psychology and neurophysiology, thermal physiology, dynamic heat and moisture transfer in textiles, physical mechanisms of temperature and moisture sensations, fabric mechanical properties and Tactile-pressure sensations and others. The touch is considered a comfort concept however, it is very difficult to quantify it due to its strong subjectivity.

So, we must be able to individualize the sensations, measure them to settle the optimal values (or threshold values) in order to obtain materials whose characteristics answer to the optimal values.

There are main areas to realize this process, namely: skin contact characteristics (hand), transport characteristics (liquids and gas), fabric draping and manufacturing characteristics, etc., but the sensory analysis is an important area however not very explored in textile materials.

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